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BEHAVIOR, COMMUNICATION, AND ASSUMPTIONS ABOUT OTHER PEOPLE'S BEHAVIOR IN A COMMONS DILEMMA SITUATION

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by

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SUMMARY

Introduction

People are often faced with social dilemmas: situations where (i) each person is individually better off defecting from a group goal than cooperating in achieving it, and (ii) all members of the group are better off if all cooperate than if all defect. This report is one of a series testing hypotheses about factors that may cause people to cooperate in such a situation. The focus of this study was the effect of communication on propensity to cooperate and on the effect of expectations about others' behavior.

Background and Approach

In order to investigate behavior in a social dilemma, an experiment involving money was devised for the purposes of this research. It was a commons dilemma--in which subjects are given a choice between defecting from a group or cooperating with it, in which the monetary payoff for defection accrues directly to the defector, and in which the monetary fine for defecting (which is greater than the payoff) is spread out among all the group members. Specifically, in groups of size 8, each subject was given a choice between making a cooperative choice (placing a 0 on a piece of paper) and earning $2.50 for participation with no fine to any other group member, or making a defecting choice (placing an X) and earning $12 with a $1.50 fine to each of the eight group members including himself or herself. Thus, each subject had an $8 motive to defect ($12.00 - $1.50 - $2.50), but if all defected, none would receive anything (eight fines of $1.50 exactly match the $12 for defecting), while if all cooperated, all would receive $2.50. The purpose of setting up this game was to investigate such variables as the effect of different types of communication concerning the dilemma, the effects of expectation about others' behavior, the effects of moral persuasion, and so on.

Previous research using less dramatic amounts of money has indicated that when people communicate in such situations, the rate of cooperation increases. There are, however, different possible aspects of communication which may account for such increase in cooperation. First, communication involves the "humanization" of other people in the experiment; that is, subjects simply get to know each other independent of anything said about the game itself. Secondly, subjects bring various characteristics of the game to each other's attention. Finally, subjects may make a commitment to cooperate with one another. A second purpose was to look at the correlation between expectations about others' behavior and the subject's own behavior. Insofar as defecting behavior in a social dilemma situation is defensive, subjects who believe that other subjects will defect may have a higher tendency to do so

themselves than will subjects who believe that most other subjects will cooperate. Finally, we wish to look at the possible effects of losing money on behavior in our experimental game. As it is set up, subjects may end up with negative amounts if they cooperate and two or more other group members defect. We cannot, of course, ethically take money away from our experimental subjects, but we devised a method by which they may temporally lose money.

There were four basic communication conditions investigated in this series of experiments: (i) no communication (subjects simply came to the room and played the game without speaking to one another), (ii) irrelevant communication (after the game was explained, subjects discussed an irrelevant topic--the proportion of people in each income bracket in Eugene, Oregon--prior to playing the game; the discussion lasted 10 minutes); (iii) communication (subjects were allowed to communicate about the game for 10 minutes, but were not allowed to make any personal commitments), (iv) communication plus vote (subjects both communicated about the game for 10 minutes and then in a roll-call made a non-binding commitment to cooperate or defect).

In addition, these four communication conditions were crossed by a loss versus no loss condition. Subjects came in groups of four friends, and two of those friends were in decision making groups in which they could temporarily lose money. Any losses they incurred were pooled with gains or losses of their other three friends, and the final amount was split between all four; if that final amount were negative, it would be truncated at 0, subjects could lose money in their particular decision making group, but could not lose money in the overall experiment.

Finally, each subject was asked to guess whether each other group member would place an 0 or an X on the piece of paper; thus, the estimated amount of defection was obtained from each.

Findings and Implications

Communication had a huge effect. The rate of cooperation in groups (iii) and (iv) was roughly 2 1/2 times that in groups (i) and (ii), 68% versus 28%. Moreover, there were no differences between groups (iii) and (iv); apparently the verbal commitment in and of itself did not add to the discussion of the problem in inducing cooperation. And there were no differences between (i) and (ii); apparently mere humanization--at least for the 10-minute period--did not make any difference. Further, there was no effect of the loss versus no loss manipulation. Finally, there was a very large correlation between defection (score 1 for defection and 0 for cooperation) and judgments about the number of other group members who would defect: across all conditions, the correlation was .60.

In order to determine whether the act of defecting or cooperating might influence the expectation as well as vice versa, an additional experiment was run in which the predictions of the participants were compared with the predictions of observers. The rationale was that to the degree to which own choice influenced judgment of others, cooperators would be biased to predict cooperation and defectors would be biased to predict defection. Hence, the variance of predictors of participants should be larger than that of observers (who, if randomly chosen, should have the same overall base rate of propensity to cooperate or defect). Ten groups of 8 subjects each were run; observers watched the groups interact, either silently or in an unstructured communication condition (public commitment permitted if subjects chose to do so), and then participants as well as observers make predictions about the behavior of each group member. The variance of the predictions of the participants was significantly greater than that of the observers, thus supporting the hypothesis that the act of decision making itself biased judgment about others' behavior.

When first discussing the prisoner's dilemma, Luce and Raiffa wrote (1957, p. 97) that there ought to be a law against it. There are laws against some prisoner's dilemmas, but modern societies seem to be inventing new ones at an alarming rate. It is, for example, to each individual's rational self interest to exploit the environment, pollute, and (in some countries) overpopulate--while the collective effect is worse for everyone than if each individual exercised restraint. Thus, individual behavior when faced with such dilemmas is a matter of increasing interest to both social scientists and people in general.

Social dilemmas--such as that in the prisoner's dillema game--are characterized by two conditions (Dawes, 1975): (i) the anti-social, or defecting, response is dominating for each individual, and (ii) the resulting equilibrium is deficient in that all individuals would prefer an outcome in which all cooperated to one in which all chose their dominant strategy of defection. Within the context of these conditions, it is possible to define a number of different social dilemmas. It turns out, however, that the most common experimental games that have been devised for studying behavior in a dilemma situation are

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all structurally identical, although often stated differently by different authors. These are: (i) N-person separable prisoner's dilemmas (e.g., Hamburger, 1973), (ii) games in which payoffs for cooperation and defection are linear functions with equal slopes of the number of cooperators (e.g., Kelley & Grzelak, 1972), and (iii) games devised according to the principle that profit for defection accrues directly to the defector while loss (which is greater than gain) is spread out equally among all the players[1] (Dawes, 1975). The purpose of the present research is to examine behavior in such an experimental game--specifically, to look at the roles of communication about the dilemma and at the relationship between one's own behavior and one's expectations about how other people will behave.

Before proceeding to the empirical study, let us first explain the game as characterized by the gain-to-self-loss-spread-out principle. The game is constructed on the basis of Hardin's (1968) analysis of the "tragedy of the commons." Each player can receive a certain amount c for cooperating, but each player can in addition receive an amount d if he or she chooses to defect. The group as a whole is fined $d + \lambda$ ($\lambda > 0$) for each defecting choice, each player's share of the fine being $(d + \lambda)/N$ where N is the number of players. Thus, each player's motive for defection is $d - (d + \lambda)/N$ which will be greater than 0 provided that $d > \lambda/(N - 1)$, a side condition. Note that if there are m cooperators, then the payoff for cooperation is $c - (N - m)(d + \lambda)/N = [(d + \lambda)/N]m + c - d - \lambda$; the payoff for defection is the same amount incremented by d. Hence, the payoffs for cooperation and defection are linear functions with equal slopes

of the number of cooperators, and as Hamburger (1973) has shown, such payoff functions define games that are equivalent to N-person separable prisoner's dilemmas.

Subjects in the experiments to be described in this paper met in 8-person groups and were faced with the following choices. A cooperative response earned $2.50 with no fine to anyone. A defecting response earned $12.00 with a fine of $1.50 to each group member including the defector. Thus, each player had an $8.00 motive to defect ([$12.00 - $1.50] - $2.50). of course, if all defect, no one receives anything. If someone cooperates and two or more other group members defect, the cooperator has a negative payoff. This investigation is the first of a series of experiments to identify situational and personal variables important to group or self-interested decisions in this dilemma. Two major variables were of interest here.

Opportunity for communication was manipulated with the expectation that people faced with this dilemma would have a better chance of resolving it if they could communicate with each other. Communication commonly results in increased cooperation in 2-person prisoner's dilemmas (e.g., Deutsche, 1960; Loomis, 1959; Radlow & Weidner, 1966; Swensson, 1967; Wichman, 1972), and had a similar effect in a 5-person social dilemma involving hypothetical business decisions (Jerdee & Rosen, 1974). Caldwell (1976) found that communication alone did not seem to be sufficient to affect subjects' decisions; nevertheless, his findings were in the right direction, although not significant, and as he, himself, notes (p. 279): "Perhaps with real money subjects would be less inclined to treat the experiment as a competitive game."

(The same possibility applies to most of the other research as well.)

Communication effects could have at least three sources. First, the opportunity to communicate allows group members to get acquainted, which could raise their concern for each others' welfare. Second, the relevant information raised through the discussion and appeals for mutual cooperation could persuade group members to cooperate. Third, group members' statements of their own intended decisions could assure other members of their good intentions, leading to higher rates of cooperation.

To distinguish between these possibilities, four communication conditions were included in the present design. No communication (N) groups worked silently on an unrelated topic before making their decision in the game. Irrelevant communication (I) groups were allowed to get acquainted with each other through a group discussion of an unrelated topic, but were not permitted to discuss the group dilemma decision. Relevant communication (C) groups discussed the dilemma situation before making their decisions, and relevant communication plus vote (C+V) groups ended their discussion with a roll call in which each group member made a nonbinding declaration of intended decision. If a roll call vote were suggested in the C groups, it was stopped by the experimenters. Thus, considering groups ordered N, I, C, C+V, each of the possible sources of communication effects were systematically added to the conditions of the previous group to see if it incremented the level of cooperation in the group.

A second major variable of interest concerned possible individual differences in cooperators' and defectors' expectations about others'

decisions. Prior work by Kelley and Stahelski (1970) on the prisoner's dilemma indicated that cooperators and competitors maintain different world views, with competitors expecting competition from other players and cooperators expecting either cooperation or competition. Subjects in Experiment 1 were asked to predict other group members' decisions to see if similar individual differences occur in the commons dilemma. Further research in Experiment 2 suggests an alternative to Kelley and Stahelski's interpretation of these differences in expectations.

A final variable manipulation was the possibility of losing money in the game. The possibility for cooperators to lose money might increase the risk associated with a cooperative decision, leading to less cooperation. Alternatively, defectors might be more reluctant to defect if their decision causes other group members to lose money. The net effect of these contrary forces was difficult to predict. Equally difficult, however, was the task of designing an experiment where loss of money was possible without violating experimental ethics.

The solution used in the experimental work was to have subjects pool their winnings or losses with friends, truncating pooled losses at zero. Thus, an individual subject could be put in a condition where he or she could lose money. Subjects came to the experiment in groups of four friends. Two of the four went to a loss condition where they individually could lose money; two went to conditions in which their potential personal losses were truncated at zero. When the four friends returned from their decision groups, their earnings were pooled and shared equally. If the net total was nega-

tive, money was not taken from the group. Thus, subjects' losses could detract from their other friends' gains, but subjects would never owe the experimenter money by the end of the experiment. In sum, communication (N, I, C, C+V) and loss (loss, no loss) conditions were crossed in a 4 x 2 factorial design.

Subjects' decisions and their expectations for others' decisions were the two dependent variables of interest.

Experiment 1

Subjects. Subjects were recruited from newspaper advertisements asking for groups of 4 friends. Eight such groups were scheduled for each time, so that one member from each "friendship group" could participate in separate "decision-making groups" of eight strangers. Since scheduled groups occasionally did not show up, a total of 284 subjects were run in 40 decision-making groups, rather than the anticipated 320.

Method

Friendship groups. Friendship groups met initially with an experimenter who informed them that each person would go to a different decision group where she or he would make a decision with 7 other people. The 4 friends would then return to their friendship group, pool their earnings, and divide them equally among themselves. If the total were negative, no member of the friendship group would receive anything (although people who did not win at least $2.00 were contacted later and paid from $1.00 to $2.50 depending on their initial earnings). One member from each friendship group was sent to each of the 4 communication conditions. Two went to groups in which it was possible to lose money, two to groups in which negative payoffs were truncated

at zero. Thus, the 8 groups of 4 friends separated and formed 4 groups of 8 strangers to play the commons dilemma game.

Decision-making groups. Payoff matrices were determined according to the rule that each member of the decision group would earn $2.50 for a cooperative choice (O) or $12.00 for a defecting choice (X). All group members were fined $1.50 for each person in the group who chose X.

When fewer than 8 friendship groups showed up for the experiment, the defectors' payoff was reduced by an appropriate amount: to $10.50 for 7-person groups, $9.00 for 6-person groups, etc.

Two payoff conditions were included in the experiment. In the loss condition, payoff to a cooperator was reduced by $1.50 for every defector in the group; in the no-loss condition, cooperators' negative payoffs were truncated at zero. Table 1 indicates all possible outcomes to decision makers under these two conditions.

Opportunity for communication was manipulated in 4 communication conditions: No communication (N): Subjects were not permitted to talk to each other. Subjects in this condition worked silently for 10 minutes on an irrelevant task (estimating the percentage of people at certain income levels in Eugene, Oregon in the United States, etc.) before making their decisions. Irrelevant communication (I): Subjects discussed the same irrelevant topic for 10 minutes before making their decisions. Relevant communication (C): Subjects discussed the commons dilemma decision for 10 minutes before making their decisions. They were not, however, permitted to take a roll call. Communication plus vote (C+V): Subjects' 10-minute discussion of the commons

dilemma decision ended in a roll call--a nonbinding declaration of intended decision.

Insert Table 1 about here

The two loss conditions were crossed with the 4 communication conditions in a 2 x 4 factorial design. Five groups were run in each condition.

Instructions were read to the decision groups as follows:

"I would like to explain the decision-making task in which you will now be participating. To insure that all of our subjects receive exactly the same information, I will have to read the instructions. Please listen carefully. I can answer questions at the end.

"This table [Table 1] indicates the possible consequences of the decision each of you will be asked to make. You must decide whether to choose an X or an O. You will have to mark an X or an O on the card in private. If you choose an O, you will earn $2.50 minus a $1.50 fine for every person who chooses X. If you choose X, you will earn $2.50 plus $9.50 minus $1.50 find for each person, including yourself, who chooses X. [However, as you can see, your payoffs do not go below zero.] By looking at the first row, for example, you can see that if 7 of you choose O and 1 of you chooses X, then those choosing O will earn $1.00 and the person choosing X will earn $10.50.

"You will write your code number and decision on the top of the sheet in your envelope. Your decision will be totally private and none of the other participants in this group will know

what you decided. You will each be paid and dismissed separately. On the sheet please indicate what decision you believe each other person here to be making. Beside the code number of each person, mark X or O to indicate the choice you believe that person to be making. Then indicate your confidence level for each judgment with a number from 50 to 100, with 100 indicating complete confidence. If you are just guessing, the probability is 50-50 that you are correct, so you should mark 50 if you have no confidence at all in your predictions. Questions?"

Once questions had been answered and group members understood the decision, they proceeded to 10 minutes of discussion or interpolated task, depending on the communication condition. When the 10 minutes were up, subjects made their decisions and predictions of other group members' decisions. Once outcomes had been determined, subjects returned to their friendship groups where they divided any net gain between themselves.

Results

Because the groups differed in size, results of defection and predicted defection are presented in percentages. Table 2 shows the average proportion of defectors in each of the eight conditions. Table 3 presents an anslysis of variance based on arc-sine transformations of the proportions (where the group is the unit of analysis).

Insert Table 2 and 3 about here

The analysis of variance indicates that the effect of communication is extremely significant. The loss manipulation was not only insignificant, but accounted for virtually no variance--as did the

communication by loss interaction. As can be seen from Table 2, there is a great deal more defection when subjects cannot communicate about the dilemma, even if they interact for ten minutes about an irrelevant topic. Moreover, the structured communication with the vote did not elicit any more cooperation than did the unstructured communication (73% versus 72% on the average).

The possible loss manipulation was not only ineffective in eliciting differential cooperation, it was ineffective in eliciting differential predictions about others' behavior as well. In the results about such prediction, potential loss will therefore not be included as a variable. What will be included is the variable concerning whether the individual making the prediction is a cooperator or a defector.

The correlation between the proportion of defections the subject predicted (not including himself or herself) and whether the subject actually defected was .60 ($p < .001$). Table 4 presents the average proportion of predicted defection on the part of <u>other</u> subjects made by defectors and cooperators in the four different communication conditions (collapsed across loss versus no loss). Table 5 presents the analysis of variance--again on these proportions transformed to arcsines. In Table 4, the subject is the unit of analysis. A total of 264 subjects made the requested predictions and were included in this analysis.[2]

Insert Tables 4 and 5 about here

There are two strong main effects, one for communication condition and one for defectors versus cooperators. Overall, more defec-

tion is predicted when people cannot communicate, and defectors predict almost four times as much defection as do cooperators. When the subject's own behavior is included in the prediction (i.e., the defector predicts himself or herself to defect and the cooperator to cooperate), the overall predictions become even more discrepant--.60 versus .13. The analysis of variance shows virtually identical results; neither it nor the proportions with the subjects included in each condition are presented here. In the results that follow, all predictions do not include the subjects themselves.

Table 6 presents the proportion of correct predictions made by defectors and cooperators in the four conditions, while Table 7 presents the analysis of variance based on the arc-sine transformations of these proportions.

Insert Tables 6 and 7 about here

Subjects overall are more accurate at predicting in the communication conditions (which is not exactly surprising), and there is an interaction between whether the subject is a cooperator or defector and the type of communication conditions. This interaction is easily explained by the fact that cooperators tend to predict more cooperation, defectors more defection--and the communication conditions tend to elicit cooperation while the no communication conditions tend to elicit defection. It follows that the cooperators are more accurate in the communication conditions and the defectors in the no communication conditions, which is the result obtained.

The overall accuracy of each subject as measured by proportion correct is directly affected by the match between the subject's base

rate prediction of defection and the actual base rate of defection. If, for example, a subject predicted r percentage of defection and p occurred, then even if the predictions were non-contingent-- that is, if the subject could not accurately predict which subjects would defect and which wouldn't--the expected proportion of correct predictions would be $rp + (1-r)(1-p)$. Each subject's actual proportion of correct predictions was corrected for this base rate accuracy, and the residuals subjected to an analysis of condition by defection. These residual scores are tiny, averaging .03. Due to the large sample size, they are nevertheless significantly different from zero. (After an arc-sine transformation with negative residuals given negative scores $F(1/248) = 8.69$, $p < .01$.) There appear to be borderline tendencies for residualized accuracy to be greater in communication conditions ($F[3/248] = 2.44$, $p < .07$) and for defectors rather than cooperators ($F[1/248] = 3.70$, $p < .06$).

Nevertheless, subjects can tell which conditions encourage defection. The correlation between amount of defection and predicted amount across conditions (S not included) is .98, while that across groups (S not included is .78).

The data were analyzed for sex differences. Across conditions, there were no significant sex differences in subjects' decisions ($\chi^2 = 1.78$, df = 1, p. > .10).

Finally, the data were analyzed for differences in defection as a function of group size. Due to no-shows, there were groups of size 5 (N = 12), size 6 (N = 5), size 7 (N = 10), and size 8 (N = 13);

the overall proportion of defectors was 46, 30, 52, and 54, respectively. The data were subjected to a 4 x 2 analysis of variance with unequal cells (Winer, p. 242) where the two levels of the second factor were defined by collapsing conditions N and I (which elicited little cooperation) and C and C+V (which elicited much). The effect of group size on proportion of defection was nill ($F[3/32] = 1.50$), as was the interaction of group size by condition ($F[3/32] = 1.47$). [3]

Discussion

It is not surprising that when people can communicate, they can solve a dilemma better than when they cannot. Simply getting to know other people did not make much of a difference, at least in the ten-minute discussion of the irrelevant communication condition. Whether subjects in more contact, or longer lasting groups would be better able to elicit implicit cooperation is an open question. For reasons to be described later in this discussion, that question may remain unanswered. At any rate, groups of strangers can in fact elicit cooperative behavior from each other if they are permitted to communicate about the dilemma for ten minutes. Even in these groups, however, many people lied about their intentions; although every vote was unanimous in favor of cooperating, there was only a single group in which all people actually cooperated. Nevertheless, the overall rate of cooperation in communicating groups was about 75%. (Interestingly enough, if the rate in each group was 75%, each cooperator would end up with no money or losing 50¢).

A much more striking finding concerns the expectations about others' behavior. Defectors predict approximately four times as much defection

as do cooperators. The present study is purely correlational--so it is not possible to determine the degree to which perception of others' intentions influences the decision to cooperate or defect, and the degree to which such a decision influences judgment about other peoples' behavior. Experiment 2 assesses the degree of such influence by comparing the judgments of people who are actually making the decisions in such groups with the judgments of observers.

The data concerning the prediction of defection indicate that people can accurately predict overall defection, and even the sources of defection. But the prediction of the individual source--when corrected for base rate--is pretty feeble; for once, we're embarrassed by having run too many subjects rather than too few--so that it is necessary to speculate about a significant effect that has virtually no import. Informal observation indicates that what was happening was that a minority of individuals very clearly indicated that they would defect or cooperate--with the result that other people are good at spotting them.

One of the most significant aspects of this study, however, did not show up in the data analysis. It is the extreme seriousness with which the subjects take the problems. Comments such as "If you defect on the rest of us, you're going to have to live with it the rest of your life" were not at all uncommon. Nor was it unusual for people to wish to leave the experimental building by the back door, to claim that they did not wish to see the "sons of bitches" who doublecrossed them, to become extremely angry at other subjects, or to become tearful.

For example, one subject just assumed that everyone else would cooperate in the no communication condition, and she ended up losing $8.00--which matched the amount of money her friends had won. She was extremely upset, wishing to see neither the other members of the decision group, nor her friends. We are concerned that her experience may have had a very negative effect on her expectations about other people (although--alas-- making her more realistic).

The affect level was so high that we are unwilling to run any intact groups, because of the effect the game might have on the members' feelings about each other.

The affect level also mitigates against examining choice visibility. In pre-testing, we did run one group in which choices were made public. The three defectors were the target of a great deal of hostility ("You have no idea how much you alienate me!" one cooperator shouted before storming out of the room); they stuck around after the experiment until all the cooperators were presumably long gone.

Experiment 2

The purposes of Experiment 2 were to replicate the findings of Experiment 1 and to explore further the source of the high correlation between subjects' own behavior and their expectations about others. Kelley and Stahelski (1970) attributed similar differences between cooperators and defectors in a prisoner's dilemma to stable differences in world view. According to them, competitive people elicit competition from both cooperative and competitive people. Their consistent experience is that people are competitive, leading to a generalized expectancy that others are like themselves. Cooperators' experience

is differentiated according to the behavior of others. Cooperative people meet with cooperation from other cooperators, competition from competitive people, resulting in a belief that others are heterogeneous with respect to the competitive dimension. According to this theory, then, defectors come to the experiment with a predispositon to expect others to behave similarly; cooperative people have no such consistent expectation.

Our interest was in the alternative possibility that the decision itself was affecting subjects' expectations about others. A couple of explanations were plausible. One source may be motivational. Subjects may feel the need to justify their decision--defectors in order to assuage possible guilt over their decision, cooperators to avoid feeling duped. A second source is cognitive. Given the belief that people tend to behave similarly in the same situation, a subject who decides to cooperate or to defect may have a rational basis for believing others will do likewise. Whichever the source, the subjects' decisions themselves would lead them to believe that others' decisions would be like theirs.

The expectation, then, is that predictions of people who actually make the decision will be different from those of people who observe the same process, but make no decision. Participant cooperators should expect more cooperation; participant defectors should expect defection. If the decision is affecting participants' expectations, then observers who make no decision should not be similarly biased. Since participants' decisions would distort cooperators and defectors' predictions in opposite directions, the variance of all participants' predictions

should be greater than the variance of observers' predictions.

On the other hand, if Kelley and Stahelski are correct, observers and participants should have similar world views, and should have the same expectations about others' decisions. Thus, the variance of predictions should be roughly the same for participants and observers, since the proportion of potential cooperators and defectors should be the same in each group.

Method

The number of conditions in Experiment 2 was reduced to two. Because potential money loss had no effect in Experiment 1, all losses were truncated at zero. Further, because there was no difference between the no communication and irrelevant communication conditions, and between the communication and communication plus vote conditions, only an irrelevant communication condition and a relevant communication condition were run--with subjects in the relevant one being free to have a roll call vote or not, depending upon the group interaction. Further, there was no need to use "friendship groups," becuse there was no necessity of having potential monetary loss.

Subjects were recruited from newspaper ads, and sixteen were scheduled for each session. Eight were to be assigned to be participants, the remaining eight as observers; because subjects sometimes failed to appear at the experiment, eight were randomly chosen to be participants--with the remainder observers. The result was that there were 160 participants and 149 observers, 10 groups being run in the irrelevant communication condition and 10 in the relevant communication condition. Because the previous results have indicated no effect of

sex, no attempt was made to balance men and women equally in the roles of participant and observer.

Procedure for decision groups was identical to that of the corresponding conditions in Experiment 1. Instructions to observers were as follows:

> "You will be observing a decision-making task in which the participants must individually decide between two choices: X and O. The outcome of the individuals in the group depends on the number of individuals choosing X and O. [Give them copies of the matrix and prediction sheets.] This will also be explained to the participants, and should be clear to you. Before the participants make their decisions, you will have an opportunity to observe a 10-minute discussion. Your task will be to predict what each individual in the group will choose: either X or O. In addition, we will ask you to indicate your confidence level for each prediction with a number from 50 to 100, with 100 indicating complete confidence. If you are just guessing, the probability is 50-50 that you are correct, so you should mark 50 if you have no confidence at all in your predictions. Please make these predictions and confidence ratings individually, without consulting one another. In addition, please refrain from commenting about the group as you observe. I will now instruct the decision-making group and will return shortly. Questions?"

Observers made their predictions at the same time as the participants made their predictions and decisions.

Results

The difference between irrelevant communication and relevant communication was replicated. In the irrelevant communication condition, 76% of the subjects defected, while in the relevant communication only 31% did so. Since all groups contained eight people, a one-way analysis of variance was performed on the number of defectors in the two conditions, the groups themselves again being the unit of analysis. The resultant F value is 41.51, which is significant beyond the .001 level. (Only one group in the irrelevant communication condition had fewer defectors than did any of the groups in the relevant condition.)

Analysis of sex differences in subjects' decisions showed that females were more likely to cooperate than were males ($\chi^2 = 3.6$, df = 1, $p < .10$). Considering the decisions within each condition, this sex difference was strong in the relevant communication condition ($\chi^2 = 7.61$, df = 1, $p < .01$), but nonexistent in the irrelevant communication condition.[4]

All the other effects for participants replicated. Table 8 presents the proportion of predicted defections made by defectors and cooperators in the two communication conditions (again, the subjects' "predictions" about themselves not being included in the prediction). As before, there is more predicted defection in the irrelevant communication condition ($F[1/156] = 49.86$, $p < .001$), and defectors predict more defection than do cooperators ($F[1/156] = 28.25$, $p < .001$).

Insert Table 8 about here

Also, as before, there's a higher proportion of correct predictions in the communication condition than in the irrelevant communication

condition ($F[1/156] = 5.70$, $p < .02$), there is no evidence of differential accuracy of defectors and cooperators ($F[1/156] = 1.09$), and there is the interaction in that cooperators are more accurate in the communication condition and defectors in the irrelevant communication condition ($F[1/156] = 6.52$, $p < .02$).

The finding of positive residual accuracy, however, was not replicated; in fact, the residual accuracy was negative, averaging -.02. But the previous marginal finding of defectors having greater residual accuracy scores than cooperators was replicated--and at a highly significant level ($F[1/156] = 12.62$, $p < .01$).

Again, there was, however, accuracy in judging which conditions encouraged defection. The correlation between obtained and predicted defection across groups (S not included) was .87.

Figure 1 presents the number of defections predicted by cooperators, defectors, and observers--broken down by conditions.

Insert Figure 1 about here

In order to make the predictions of participants and observers comparable, each participant was assumed to have made an (implicit) prediction for himself or herself; in addition, each observer was randomly paired with a participant, and the prediction of the observer for that participant was changed if it was incorrect. Thus, the observers and participants were put in the same situation--guessing about seven of the choices and knowing about one.[5] The variance of predictions for the participants was 7.50, whereas that for the observers was 4.60; the F value for testing the null hypothesis of equal variance is 1.63

($p < .01$). In the irrelevant communication condition, the variances are 5.24 for participants and 3.20 for observers ($F = 1.64$, $p < .05$), while in the communication condition, the respective variances were 3.84 and 3.65 ($F = 1.05$, NS).

Discussion

The most important finding of this experiment was that having to make the cooperative or defective choice apparently did affect the estimates of what other people would do, as well as vice versa. Thus, one's choices in such a dilemma situation not only reflect beliefs about others--but affect these beliefs as well. There are a number of possible explanations.

First, the effect may be pure rationalization. Having decided to cooperate or defect, the group member may attempt to justify the choice by his or her estimates of what others will do. Clearly, a cooperative choice is not very wise if any other people are going to defect--while a defecting choice may be considered downright immoral if most other people cooperate. Thus, the group member may have a motivational reason for believing that other people will behave in a similar manner; specifically, such a belief helps the individual maintain an image of being a rational, moral person.

Second, there may be two closely related cognitive reasons for the behavior to affect the belief. Individuals may decide to use their own behavior as information about what other people would do; after all, if people from similar cultures tend to behave in similar ways in similar situations, and if I do this, it follows that my peers

may do so also. In addition, there is the possibility that as I make up my mind to defect or cooperate, the reasons leading to the choice I finally make become more salient, while those leading to the other choice become less so. Then, when attempting to evaluate what other people will do, I see compelling reasons for doing what I do--and less compelling ones for doing the opposite.

As suggested by our colleague, David Messick (Note 1), one such reason may involve the ethical implication of the choice--that when people perceive an ethical dimension or component in a particular social choice, they may have a tendency to assume that other people will have the same perception (for example, the individual who perceives a particular social choice in terms of a fundamental religious struggle between good and evil tends to believe that others would view it along the same dimension, and that the atheist or agnostic who denies such a perception is simply lying or deluding himself). Thus, the act of making a choice considered ethical or rational may define the situation for the chooser as one requiring ethicality or rationality, and hence bias the chooser to believe that others will behave in a similar ethical or rational manner.

Finally, since sex differences appeared in only one condition in one experiment, they cannot be regarded as consistent.

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Footnotes

1. Messick's (1973) union dilemma game also is structurally identical, although in a probabilistic context.

2. Tables 4, 6 and 8 are abstracted from 3-way ANOVA's including payoff type. The analysis is based on 264 subjects but the 8 degrees of freedom associated with the payoff variable and its interactions (all non-significant) are omitted.

3. A linear trend analysis using coefficients -3, -1, +1, +3 and the same error term used in the Weiner analysis revealed even less evidence for a size effect. The F value was 1.44.(See Hays, p. 587 for a description of such a trend analysis.)

4. Subsequent studies--not reported here--all support the findings of Experiment I; we have never been able to replicate the sex effect.

5. The rationale for this procedure may best be explained by example. Suppose that four of the eight group members defect. A cooperator is facing seven other group members, of whom four--or 57%--defect; a defector is facing seven other group members, of whom three--or 43%--defect; an observer is facing eight group members of whom four--or 50%--defect. By including the participants' own choice in the predictions, cooperators, defectors, and observers are all facing the same situation--eight group members of whom four defect. Such an inclusion, however, means that for the participants, one of the "predictions" (of their own behavior) is not a guess but a certainty. To make the choices of the observers strictly comparable to the participants, one of their predictions was turned into a certainty by randomly pairing them with a group member and changing

the predictions of that group member if it were wrong. Many other means of achieving comparability were considered over a four-month period, and all were rejected. The reasons for such rejection would be too lengthy to detail here.

TABLE 1

Payoff Matrix: Loss Condition

Payoff to X	Number Choosing X	Number Choosing 0	Payoff to 0
	0	8	2.50
10.50	1	7	1.00
9.00	2	6	- .50
7.50	3	5	-2.00
6.00	4	4	-3.50
4.50	5	3	-5.00
3.00	6	2	-6.50
1.50	7	1	-8.00
0.00	8	0	

Payoff Matrix: No Loss Condition

Payoff to X	Number Choosing X	Number Choosing 0	Payoff to 0
	0	8	2.50
10.50	1	7	1.00
9.00	2	6	-0-
7.50	3	5	-0-
6.00	4	4	-0-
4.50	5	3	-0-
3.00	6	2	-0-
1.50	7	1	-0-
0.00	8	0	-0-

Table 2

Proportion Defecting

	No Communication N	Irrelevant Communication I	Unrestricted Communication C	Communication plus vote C+V
Loss	.73	.65	.26	.16
No Loss	.67	.70	.30	.42

Table 3

Analysis of Variance

	S.S.	Df	M.S.	F
Loss (L)	.12	1	.12	.35
Communication (C)	9.52	3	3.17	9.36 ($p < .001$)
LC	.75	3	.25	.74
Error	10.85	32	.34	

Table 4

Proportion Predicted

(S not included)

	N	I	C	C+V	Overall
Defectors	.65	.61	.29	.30	.54
Cooperators	.35	.42	.08	.04	.16

Table 5

Analysis of Variance

	S.S.	Df	M.S.	F	
Communication (C)	46.14	3	15.38	40.92	($p < .001$)
Defectors vs. Cooperators (D)	27.71	1	27.71	73.74	($p < .001$)
CD	1.65	3	.55	1.46	
Error	93.21	248	.38		

Table 6

Proportion Correctly Predicted

(S not included)

	N	I	C	C+V	Overall
Defectors	.56	.57	.67	.74	.60
Cooperators	.35	.54	.73	.76	.66

Table 7

Analysis of Variance

	S.S.	Df	M.S.	F	
Communication (C)	15.88	3	5.29	19.73	($p < .001$)
Defectors vs. Cooperators (D)	.43	1	.43	1.60	
CD	3.43	3	1.14	4.27	($p < .01$)
Error	66.52	248	.27		

Table 8

Proportion Predicted

(S not included)

	I	C	Overall
Defectors	.67	.30	.56
Cooperators	.38	.11	.18

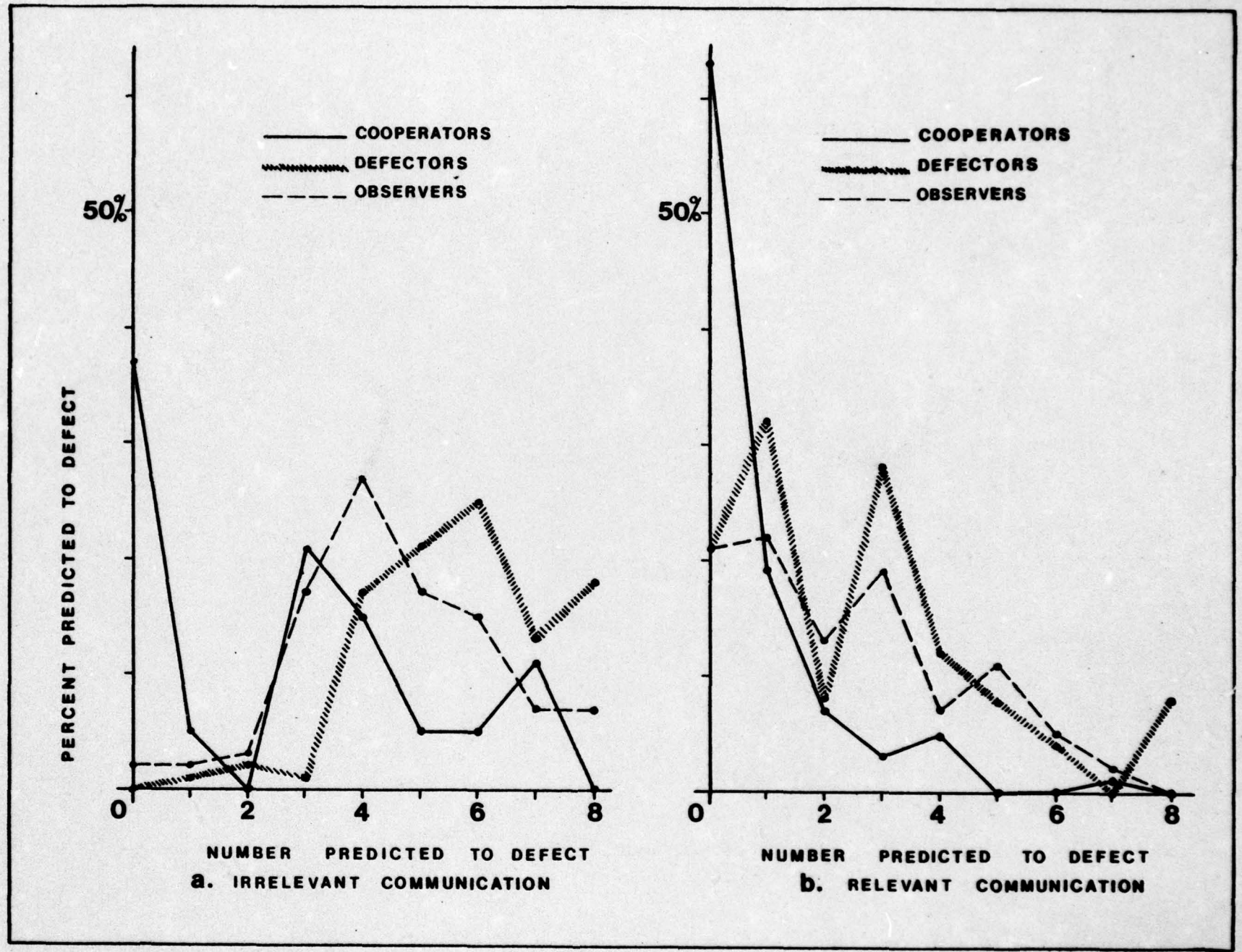

Figure 1
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Two experiments investigated effects of communication on behavior in an 8-person commons dilemma of group versus individual gain. Subjects made a single choice involving a substantial amount of money (possible outcomes ranging from nothing to $10.50). In Experiment 1, 4 communication conditions (no communication, irrelevant communication, relevant communication, and relevant communication plus roll call) were crossed with the possibility of losing money (loss, no loss). Subjects chose defecting or cooperating responses and predicted responses of other group members. Results showed defection significantly higher in no communication and
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irrelevant communication conditions than in relevant communication and relevant communication plus roll call conditions. Loss had no effect on decisions. Defectors expected much more defection than did cooperators. Experiment 2 replicated irrelevant communication and communication effects, and compared predictions of participants with those of observers. Variance of participants' predictions was significantly greater than that of observers, indicating that participants' decisions were affecting their expectations about others' behavior.